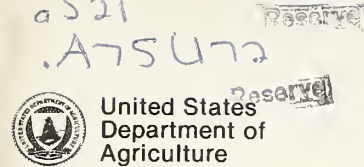


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# Receivers' Packaging Preferences and Packaging Deterioration Problems of U.S. Variety Meats Observed at European Markets

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## ABSTRACT

Miller, W. R., and A. J. Bongers. 1981. Receivers' packaging preferences and packaging deterioration problems of U.S. variety meats observed at European markets. U.S. Department of Agriculture, *Advances in Agricultural Technology* 6, 26 pp.

This report describes packaging preferences of 48 participants in the European meat trade. They preferred (1) full or folded full telescope boxes constructed of solid fiberboard material and closed with nonmetal strapping; (2) net box weights ranging from 11.34 to 15.88 kg (25-35 lb) for beef kidney, beef tongue, and pork liver sold retail; (3) net box weights ranging from 22.68 to 27.22 kg (50-60 lb) for beef liver, pork kidney, and pork liver for processing; (4) beef liver and beef tongue individually wrapped for retail and process use, and pork kidney and pork liver bulk packed regardless of usage; (5) pallet bases measuring 120 by 100 cm with four-way entry; and (6) pallet units weighing from 1.0 to 1.5 metric tons (gross) and not more than 180 cm in height. Crushed boxes caused by underfilling and blood-stained boxes were principal packaging deterioration problems observed.

**KEYWORDS:** Beef kidney, beef liver, beef tongue, export, frozen offal, frozen variety meat, packaging, pork kidney, pork liver, unitization.

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245  
RECEIVERS' PACKAGING PREFERENCES AND PACKAGING DETERIORATION  
PROBLEMS OF U.S. VARIETY MEATS OBSERVED AT EUROPEAN MARKETS

by W. R. Miller and A. J. Bongers 1/

Preliminary investigations made in 1978 by the authors with major European importers, steamship companies, handling agencies, European port health authorities, and U.S. Government officials showed that in certain instances the packaging of U.S. frozen variety meat (VM) had deteriorated on arrival at European destinations. Literature by G. James and B. H. Ashby in 1973 described problems in packaging and handling fresh meat products, including some VM in the U.S. domestic market. However, little or no information was available on the problems of U.S. VM packaging at export destinations. A comprehensive study then was made during 1979-80 to determine (1) European preferences for packaging and presentation of selected VM and (2) causes for deterioration of VM packaging during shipping and handling to major export markets.

Harmonized nomenclature for foreign trade statistics of the EC-member countries (NIMEXE) for 1974-79 indicates that the United States is a major consistent supplier of VM to the European market. During 1974-79, the United States supplied 35.6, 34.8, 35.4, 34.6, 34.1, and 30.9 percent, respectively, of the total edible beef and pork VM to the European Economic Community (EEC). Table 1 shows that the United States had a considerable share of the market for both total beef and pork VM and a large share of the beef and pork liver market for the EEC. The survey market area (SMA) defined for this project included Belgium, France, the Netherlands, and the United Kingdom. The SMA imported nearly all its beef VM in 1974-79 except 1976 and more than 90 percent of its pork VM from the United States during 1975, 1976, and 1978 and 83.9, 76.7, and 85 percent during 1974, 1977, and 1979, respectively. Therefore, the SMA imported most of the U.S. VM marketed in western Europe.

The major usage for a particular VM may vary between importing countries. For instance, beef tongues are used primarily in the fresh retail market in France, whereas they are usually processed or canned in the United Kingdom. Regardless of the particular usage, VM is considered an important source of protein in the European diet. Products merchandized as fresh frozen are displayed for consumers. The visual impression given by the general external appearance of the box containing this product and its presentation within the box are important subjective indications of product acceptability for human consumption.

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Table 1.--Edible beef and pork variety meat (VM) imports in metric tons to European Economic Community (EEC) and survey market area (SMA) 1/ from United States and all other sources during 1974-79

Import years	Total VM to EEC	Total beef VM to EEC	U.S. beef VM to EEC	U.S. beef VM to SMA	Total beef liver to EEC	U.S. beef liver to EEC	U.S. beef liver to SMA
1974----	234,006	128,645	58,166	57,701	31,692	14,371	14,237
1975----	271,902	157,340	68,577	68,246	38,005	17,502	17,485
1976----	320,562	194,597	84,979	64,243	46,759	22,446	21,960
1977----	359,209	237,070	91,415	90,425	119,113	48,739	48,274
1978----	367,341	226,146	90,014	89,623	48,700	25,578	25,367
1979----	318,597	177,312	65,809	65,713	32,903	15,831	15,683

Import years	Total pork VM to EEC	U.S. pork VM to EEC	U.S. pork VM to SMA	Total pork liver to EEC	U.S. pork liver to EEC	U.S. pork liver to SMA
1974-----	105,361	25,164	21,119	40,577	17,766	14,192
1975-----	114,562	25,999	24,350	46,705	17,452	15,960
1976-----	125,965	28,757	28,001	49,809	21,060	20,425
1977-----	122,139	33,163	25,438	44,731	23,320	16,730
1978-----	141,195	35,143	33,246	48,228	23,287	18,864
1979-----	141,285	32,686	27,865	47,305	20,939	16,665

1/ Survey market area = Belgium, France, Netherlands, and United Kingdom.



EEC countries enforce strict import regulations on all VM imported for human consumption. All imported lots are inspected by health authorities. (Import regulations enforced by EEC countries are available at the Food Safety and Quality Service agency, U.S. Department of Agriculture, Washington, D.C. 20250.) VM arriving at ports of entry in boxes that are stained and weak because of blood leakage, excessively crushed, or torn may be determined unfit for human consumption. VM arriving in packaging that is in satisfactory condition implies the product was properly packed and frozen following evisceration and handled without defrost at transfer points during distribution.

This report details the results from interviewing 48 European buyers, handlers, and users of U.S. VM. It describes their specific packaging preferences, identifies the essence of some packaging deterioration, and shows probable causes for such deterioration as observed at major ports of entry, wholesale markets, and processor facilities.

## PROCEDURES AND METHODS

Beef livers, kidneys, and tongues and pork kidneys and livers were the specific products selected for this study because they accounted for the major volume of U.S. VM imported by the SMA.

Names and locations were obtained from various sources of major European brokers, wholesalers, processors, and firms providing such services as steamship, stevedoring, and cold storage and the transportation companies handling or using U.S. VM. A questionnaire was developed to facilitate uniform questioning of participants. It was designed to ascertain specific packaging problems experienced on arrival, preferences for packaging and presentation of each meat organ by market usage, and methods of handling at transfer points for frozen VM. All information was obtained by personal contact and on site observations. The number of firms participating in the study by primary market function is shown in table 2, and the number buying, selling, or using specific meat organs is given in table 3.

Information on preferences for specific packaging is generally categorized by the primary market function of the reporting firm or in some situations for specific products by either retail or process usage.

Unloading operations of two conventional ships and several van containers were observed at the ports of Sheerness and Felixstowe in the United Kingdom and at the port of Rotterdam, the Netherlands. Major wholesale meat markets were visited in London and Paris.

The packaging material used to protect VM of U.S. origin on site during these visits was evaluated by using the criteria in table 9 (appendix). When possible, probable causes for packaging deterioration were determined. However, actual causes could not be ascertained because only destination observations were made.

Interviewing participants and on site observations were conducted within the SMA by country in the following order: United Kingdom, France, Belgium, and the Netherlands. Within a country, the ports of entry, health officials, steamship companies, and wholesale markets were generally visited first. Secondly, brokers and wholesalers were contacted. Processors and cold storage and transit facilities were generally visited last.

The term "packaging" as defined here comprises all aspects of product placement in the box and resulting presentation or appearance. This includes all accessory material used inside the box for product protection and such factors as dimensions, design and closure of boxes, net weight of product per box, and compatibility of the box in relation to interfacing with handling systems used at transfer points.

Table 2.--Number of firms participating in study by market function

Market function	Firms by primary function	Firms by primary and other functions
Importer: <u>1/</u>		
Broker-----	5	25
Wholesaler-----	19	20
Processor-----	4	5
Retailer-----	1	3
Processor-----	6	6
Wholesaler-----	1	1
Service:		
Physical <u>2/</u> -----	10	26
Nonphysical <u>3/</u> -----	2	2
Total-----	<u>4/</u> 48	88

1/ Buys direct from United States.

2/ Physically handles product.

3/ Port health authorities.

4/ Includes Belgium 8, France 16, Netherlands 11, and United Kingdom 13 firms.

Table 3.--Number of firms participating in study and marketing U.S. variety meats by organ and market usage

Variety meat organ	Market usage	Number of firms
Beef liver-----	Retail-----	24
	Process-----	22
Beef kidney-----	Retail-----	11
	Process-----	16
Beef tongue-----	Retail-----	16
	Process-----	21
Pork kidney-----	Retail-----	4
	Process-----	6
Pork liver-----	Retail-----	7
	Process-----	25

Figures 1 and 2 depict the typical European transportation and marketing flow, respectively, for VM.

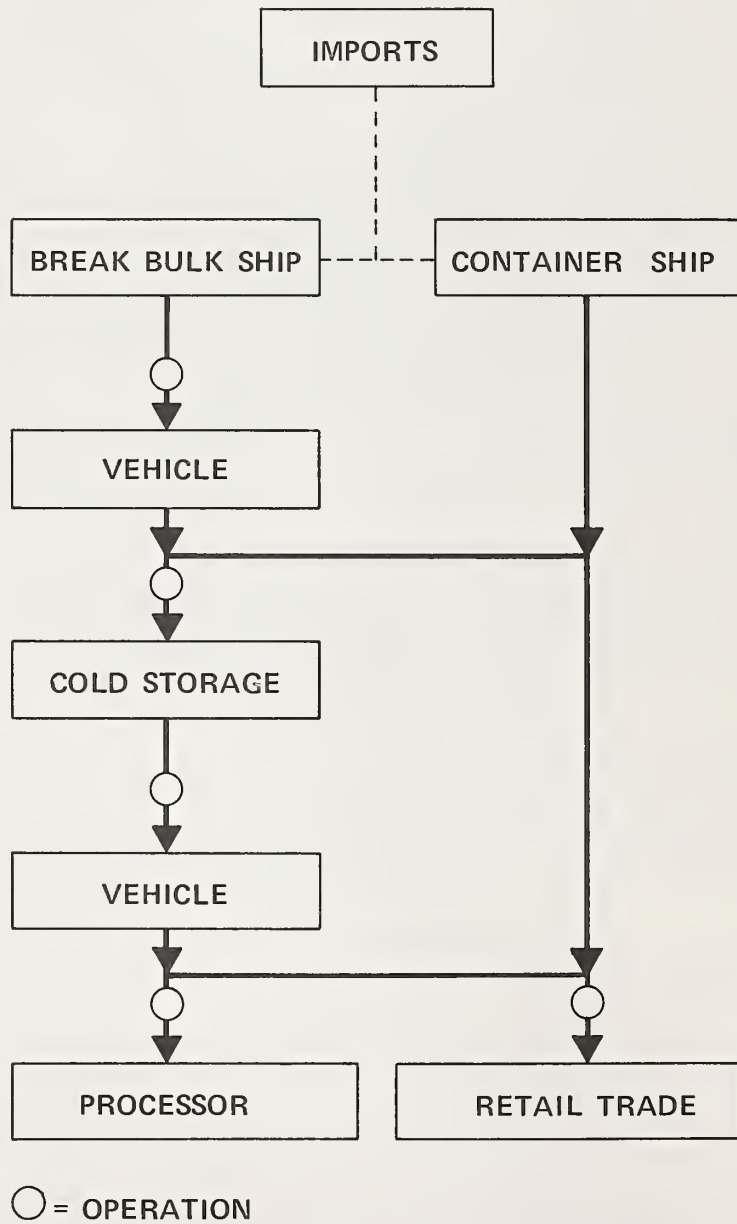


Figure 1.--Typical European transportation flow diagram for variety meat.

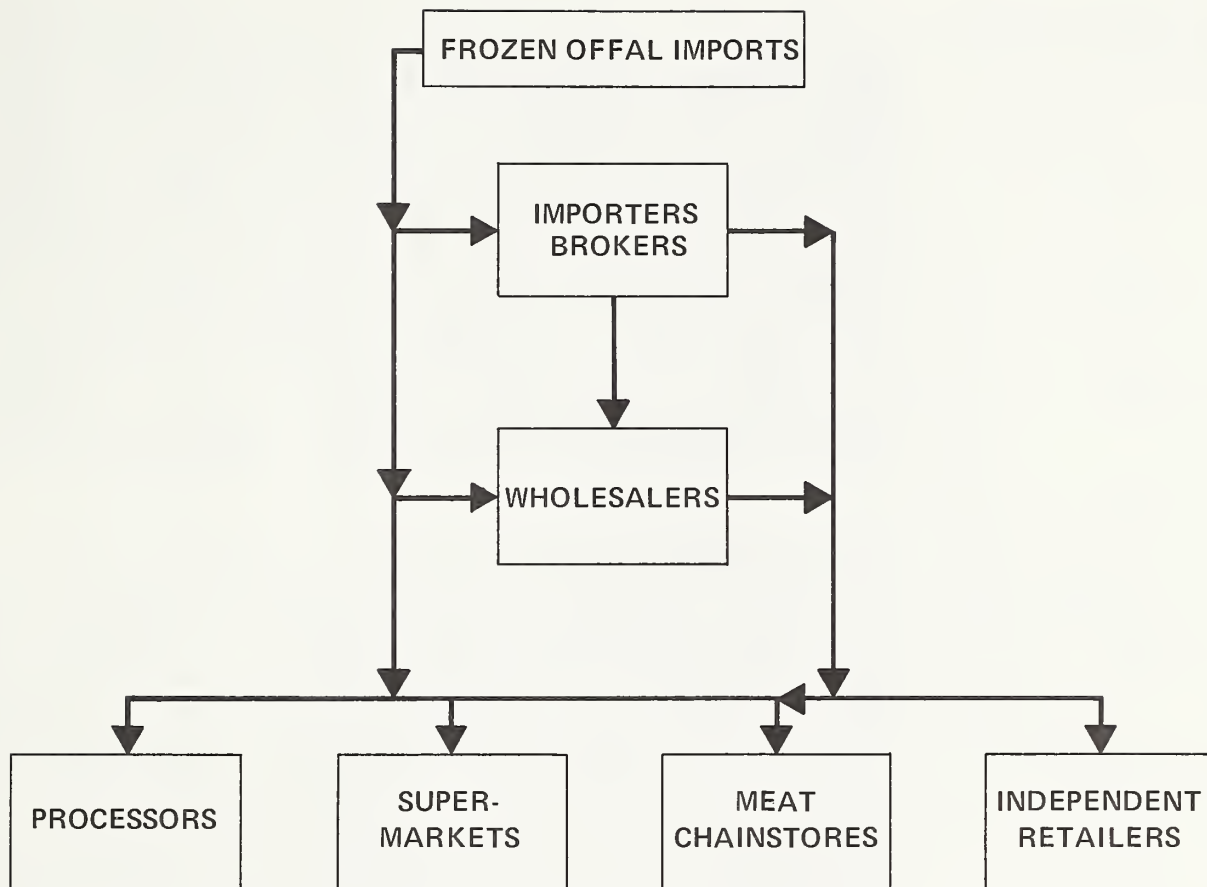


Figure 2.--Typical European marketing flow diagram for variety meat.



## RESULTS

### PACKAGING PREFERENCES Box Design

Participants were asked specific detailed questions concerning their preferences for box design, considering such factors as style, material, waxing, color, closure, and use of metal materials. Their responses by number of firms are listed in table 4, including all firms categorized in table 2. Responses of "no preference" are also listed. Most preferred either a full or folded full telescope box constructed of solid fiber-board material, closed either by folding or gluing with nonmetal strapping. Twenty-seven percent preferred waxing only on the inside box surface. Most stated that internal box waxing is not necessary when the product is enclosed in polyfilm. <sup>2/</sup> Most reported "no preference" for box color, but wholesalers frequently stated that light-colored, attractively printed boxes are beneficial for retail usage. Most firms, especially processors, were opposed to metal staples or straps.

Reported preferences of net weight per box for each VM by market usage (retail sale or process) are shown in table 5. The number of responses for each net weight category by product and by usage also provides the number of firms handling a particular VM included in the survey sample. Interviewees were asked to respond to the preferred net weight per box based on their market experience and were not given a categorized breakdown of potential net weights. Therefore, some responses were given in a range such as 11.34-13.61 kg (25-30 lb) or 22.68-27.22 kg (50-60 lb). Most stated that a net weight per box greater than 27.22 kg was too heavy for the following reasons: (1) Some employees could not handle more than 27.22 kg; (2) labor restrictions prohibited or were being more rigidly enforced to prevent manual handling of over 27.22 kg; (3) frozen products heavier than 27.22 kg required an excessive length of time for defrosting, when required, prior to usage. The highest frequency of responses for both retail and process usage was within 11.34-15.88 and 22.68-27.22 kg; however, a general tendency is shown for retail usage at 11.34-15.88 kg, whereas for process use it is toward 22.68-27.22 kg. The exception is for pork kidney, where both retail and process usage tends toward the heavier net weight. Most interviewees reported pork kidneys for retail use as of relatively small volume. For certain VM in which each piece weighs a substantial percentage of the total net weight per box, such as beef liver and beef tongue, the number of preferred pieces per box is as important as or more important than the preferred net weight per box.

The number of responses for net-weight-per-box preferences by the primary market function is given in table 6.

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<sup>2/</sup> "Polyfilm" used as a general term. Polyethylene material generally used for meat products.

Table 4.--Number of firms reporting preferences for box construction factors

Response	Box styles		Box material			Waxing		Closure		
	Full telescope	Folded full telescope	RSC 1/	Solid	Corrugated	Internal	External	Nonmetal strapping	Glue	Metal material
Yes-----	27	14	0	18	3	13	3	33	8	0
No-----	0	10	22	1	16	13	23	4	24	32
No preference-----	21	24	26	29	29	22	22	11	16	16
										37

1/ Regular slotted container.

2/ Includes 2 white, 2 multicolor, and 1 light color.

Table 5.--Reported preferences for net weight per box by market usage and meat organ

Net weight (kg)	Retail						Process					
	Beef			Pork			Beef			Pork		
	Liver	Kidney	Tongue	Kidney	Liver	Total	Liver	Kidney	Tongue	Kidney	Liver	Total
6.81	1	---	---	1	1	3	---	---	---	---	---	---
9.07	---	1	2	---	---	3	---	---	1	---	2	3
11.34	7	1	1	2	1	12	2	---	3	---	---	5
13.61	7	9	4	---	9	29	3	7	3	---	4	17
15.88	1	1	4	---	2	8	1	---	3	---	---	4
18.14	---	---	---	---	1	1	---	---	1	---	---	1
22.68	---	---	---	1	---	1	1	---	1	1	6	9
24.95	5	1	1	---	---	7	5	1	2	---	2	10
27.22	6	2	1	5	1	15	12	7	13	6	16	54
29.48	---	---	---	---	---	---	---	---	---	---	2	2
36.29	---	---	---	---	---	---	1	1	1	1	2	6
45.36	---	---	---	---	---	---	---	---	---	---	4	4
Total-----	27	15	13	9	15	79	25	16	28	8	38	115

Table 6.--Number of firms by primary market function reporting net-weight-per-box preferences for variety meat by market usage and organ

Market function	Retail						Process					
	Beef			Pork			Beef			Pork		
	Liver	Kidney	Tongue	Kidney	Liver	Total	Liver	Kidney	Tongue	Kidney	Liver	Total
Broker-----	3	4	2	0	5	5	5	5	5	2	7	7
Wholesaler-----	22	11	9	9	10	16	16	9	13	6	22	22
Processor-----	2	0	2	0	0	4	4	2	10	0	9	9
Total-----	27	15	13	9	15	25	25	16	28	8	38	38



Product Presentation  
and Packing

Observations of boxed product revealed U.S. packers used accessory material, such as polyfilm wrappers 3/ or polyfilm bags, differently for packaging various VM. For example, organs may be individually wrapped (IW) in a polyfilm bag or in a folded sheet of polyfilm or bulk packed; or all IW or non-IW organs packed in a box may be enclosed in the box with or without an additional polyfilm wrapper. Table 7 shows product packing preferences by market usage for individually and polyfilm wrapped organs where the entire product is enclosed within a box.

Table 7.--Preferences for product packing in box by meat organ and market usage

Meat organ and market usage	Number of firms	Preference for--					
		Individually wrapped			Polyfilm wrapped <u>1/</u>		
		Yes	No	None	Yes	No	None
Beef liver:							
Retail-----	23	18	4	1	14	6	3
Process-----	22	16	6	0	17	4	1
Beef kidney:							
Retail-----	11	5	<u>2/</u> 6	0	10	0	1
Process-----	16	1	<u>3/</u> 15	0	16	0	0
Beef tongue:							
Retail-----	16	13	2	1	10	1	5
Process-----	21	8	13	0	19	1	1
Pork kidney:							
Retail-----	4	0	<u>2/</u> 4	0	4	0	0
Process-----	6	0	<u>4/</u> 5	1	6	0	0
Pork liver:							
Retail-----	7	0	<u>3/</u> 7	0	7	0	0
Process-----	26	0	<u>5/</u> 25	1	26	0	0

1/ All organs in box wrapped in mass with polyfilm.

2/ 1 preferred multipacked - 4.54-kg units per box.

3/ 2 preferred multipacked - 4.54- or 6.81-kg units per box.

4/ 1 preferred multipacked - 5.44-kg units per box.

5/ 2 preferred multipacked - 4.54-kg units per box.

3/ Wrapper used to contain one or more organs and to separate them from one another or to separate all IW or non-IW organs in a box from its internal surface.

Beef Liver.--Beef liver is difficult to pack or box because of its very irregular shape, and thus some buyers and users suggested preforming or block forming beef livers to box dimensions prior to placing them in the box. Most firms reported a preference for packaging one or two beef livers per box, individually wrapped, with an additional polywrapper enclosing the one or two polybagged livers for added protection to retard or prohibit blood leakage. When polybags are used for IW, the bag mouth must be closed tightly by twisting, folding, or both. Most users suggested closing the bag with nonmetal material to prevent leakage. They also suggested that beef liver be well drained prior to packing to reduce discharge of liquid after packaging.

Beef Kidney.--Approximately half the firms handling beef kidneys for the retail trade preferred an IW pack, whereas most processors preferred a non-IW pack. A single polyfilm wrapper enclosing all the product within a box was generally desired by both retailers and processors. Several users also reported a preference for multipacked units weighing either 4.54 or 6.81 kg and packed in a box.

Beef Tongue.--Most European buyers preferred to purchase tongues by strict specifications, i.e., color, weight, surface condition, age, sex, fat, trim, and specific packaging. Generally most buyers and users of beef tongue for retail use preferred individually polybagged tongues with an additional polywrapper enclosing the total contents within the box. Most preferred 6-10 tongues per box. Most reported that tongues for retail use should fit tightly in the polybag to give a good product appearance when the box is opened and used during merchandizing display. Several users preferred that tongues be "rollpacked," where the tongue tip is rolled under the root. A firm supplying tongues direct for freezer center <sup>4/</sup> sale also desired two tightly packed tongues per polybag. Several firms preferred tongues in a shrink film pack for retail. A single-layer pack was generally desired for retail use. For process use, the trade generally liked a non-IW pack but with all tongues in a box enclosed in a polywrapper. However, eight firms preferred an IW pack for processing. Thirteen firms reported no preference when asked the desired number of beef tongues per box. The reader should recall, however, that a heavier net weight per box was desired when used for process than for retail usage. Several tongue processors, especially canners, preferred a double-layer pack.

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<sup>4/</sup> A type of European retail store where all merchandized food products are sold in frozen state.

Pork Kidney and Pork Liver.--Packaging preferences for both pork kidneys and pork livers were similar. Firms preferred a non-IW pack but with a polywrapper enclosing the product mass. Multi-packed wrap units of 4.54, 5.44, or 6.81 kg arranged in a box were also preferred by several firms.

For all VM, the polyfilm wrapper must totally enclose all six sides of the contents within a box. The ends of the polywrapper must be folded tight and in such a way that the ends of the polyfilm do not become entrapped with the frozen organs. Many firms reported that polyfilm entrapment is a problem, especially for processed products.

Other Specific  
Packaging Factors  
To Be Improved

All participants were asked to consider their complaints relative to the general packaging condition of VM imported from the United States and from all other sources and to identify specific factors related to packaging and handling that would improve distribution and marketing of these products. Forty-one firms reported at least 1 suggestion and 7 indicated no improvements were necessary. The following suggestions and complaints were given in descending order of frequency:

- (1) All metal material used in box assembly and closure should be avoided.
- (2) Overfilling boxes, which causes excessive bulging, should be eliminated.
- (3) Some packers use too small lettering for lot numbers and thus make sorting operations difficult.
- (4) Metric units or both imperial and metric units should be used to designate net weight per box.
- (5) Net weights per box for some products used by some packers are too heavy, generally those greater than 27.22 kg.
- (6) Some boxes used for products by packers are too weak or too flimsy.
- (7) Some destination labels, lot numbers, and so forth are not legible.
- (8) Box sizes and net weights used by U.S. packers should be more standardized.
- (9) Polyfilm is often entrapped among frozen organs.
- (10) Blood leakage is a particular problem of beef livers and causes blood-stained boxes.

- (11) Printing of major identifying words should be both in English and the local language.
- (12) Some boxes are excessively crushed on arrival.
- (13) Some boxes are excessively torn on arrival.
- (14) Strapping used for box closure is frequently loose.
- (15) The product freezing date should be stamped on each box.
- (16) Packinghouses should consistently use the same brand, logos, and box color.
- (17) External box surfaces should not be waxed.
- (18) Box constructions used by U.S. packers should be more standardized.

#### BOX HANDLING PREFERENCES

Handlers, receivers, and users of VM were asked to respond to specific questions regarding current handling practices used at their facilities and facilities of their first customer. They were also asked to give their preferences for receiving either unitized or nonunitized VM and to describe pallet bases that were compatible with their current handling systems. Interviewees' responses by market function to this inquiry are listed in table 8. VM is shipped either via refrigerated van containers or conventional freezer ships and is generally not unitized. Most receivers, buyers, and users unitize at the point or site of first unloading on arrival. Most interviewees stated that their first customers could handle unitized cargo when either for their own firm or for resale. More than 50 percent stated they preferred receiving unitized VM. Four service firms handling VM stated that the decision to unitize should be determined by receivers, buyers, and users.

Most persons described the most desirable pallet base as 120 by 100 cm with a four-way entry. The gross weight of a pallet unit of cargo should range from 1 to 1.5 metric tons and not exceed 1.8 meters in height. Some handlers stated boxes should also fit efficiently on a 120- by 80-cm base, which is sometimes used.

Advantages and disadvantages of receiving VM unitized by firms are as follows:

#### Advantages:

- (1) Will reduce product exposure time in ambient air.



Table 8.--Current use and preference for unitized methods of handling variety meat (VM) by market function

Market function	Type carriers used for sea transport <u>1/</u>		VM currently unitized on ship			VM unitized on arrival at quay			
	Refrigerated van container	Conventional freezer ship	Yes	No	Some	Yes	No	Some	Unknown
Broker-----	5	4	0	5	0	2	1	2	0
Wholesaler--	19	18	1	19	0	12	5	3	0
Processor---	9	6	0	10	0	8	1	1	0
Retailer----	1	0	0	1	0	1	0	0	0
Service - physical--	---	---	0	7	3	7	1	1	1

Market function	Can first receiver handle unitized VM?				Is unitized VM preferred on board ship?			
	Yes	No	Some	Unknown	Yes	No	Some	Unknown
Broker-----	2	0	1	2	2	0	1	2
Wholesaler--	13	3	1	2	13	4	0	3
Processor---	8	1	0	1	7	2	0	1
Retailer----	1	0	0	0	1	0	0	0
Service - physical--	10	0	0	0	6	0	0	4

1/ Both type carriers used by some firms.

- (2) Will reduce box damage.
- (3) Will reduce pilferage.
- (4) Will reduce number of times boxes are handled individually.
- (5) May increase efficiency of storage space used.
- (6) May reduce total costs of handling during distribution.
- (7) Is consistent with trend to unitize.

Disadvantages:

- (1) Unitization may increase per unit price delivered.
- (2) Savings in costs from unitizing may not be realized by final buyer or user.
- (3) Some receivers not interested in unitized cargo.
- (4) Some depots not equipped to handle unitized cargo.
- (5) Some ships not equipped for unitized cargo.
- (6) Cargo space on ships and lorries may not be efficiently used.
- (7) Pallet bases may become damaged.

ARRIVAL PACKAGING  
AND HANDLING  
OBSERVATIONS

Observations were made during unloading and handling operations of both van container and conventional shipments of U.S. VM at European ports of entry to determine the packaging condition on arrival. This discussion includes specific packaging deterioration problems that occurred and probable causes. The reader should be aware that on arrival most packaging of VM was in satisfactory condition; however, only the unsatisfactory packaging problems are discussed.

Boxes of VM discharged from conventional ships (fig. 3) were manually placed on stevedore pallets or on metal cages (fig. 4) in the ship's hold and hoisted to the quay. Boxes were then moved to a quay side sorting shed either for inspection and further sorting or for temporary hold awaiting further transport. Some lots were put directly on lorries for transport to public or private cold storage facilities. Time required to sort boxes into lots was related to the amount of difficulty stevedores had in seeing and reading lot numbers that were stenciled on boxes or on labels. Some shipments were discharged during darkness and lettering on boxes was difficult to read



Figure 3.--Boxes of U.S. variety meat in hold of conventional ship at port of Sheerness, U.K. Note bulge-packed boxes in upper layers require dunnage.



Figure 4.--U.S. variety meat on stevedore cage. Note bulge-packed boxes do not stow in a rigid stack.



even though working lamps were used. Most stevedores stated that lot identification numbers should be approximately 5 cm (1.97 in) high and placed consistently at the same location on the box (generally preferred on both box end surfaces), with no overlaying of other stamping or writing, such as inspection stamps or net weight markings.

Boxes in the upper layers of figure 3 are bulge packed or overfilled. Bulged boxes cause unstable stowage of cargo in ship holds. Dunnage (note wood strips between box layers) was used to stabilize this cargo during the sea voyage, but it increases total stevedoring costs. Note that since boxes on the lower layers in figure 3 are flat packed, they stack well, provide stable cargo, and require no dunnage. Overfilled boxes cause unstable stacking through the total distribution system. Boxes in figure 4 on the stevedore cage do not stow in a rigid stack. When this particular cage was hoisted from the ship's hold to quay side, five boxes fell on the ship's deck. Thus, excessively overpacked boxes will cause unstable stacking and handling problems throughout distribution. Similar stacking difficulties of boxes were observed in van container shipments where boxes were seriously deformed. Those in figure 5 are in serious misalignment, apparently because they were deformed compared with boxes stacked in the van container in figure 6.

Since most VM is very irregular in shape, completely filling the box is difficult. The most noticed cause of box crushing was unfilled space in a box of packed product. Figures 7 and 8 present good examples. Boxes containing pork kidney (fig. 7) are shown stacked in a conventional ship on arrival at a European port. Many in this particular lot were seriously crushed. Several sample boxes of this lot were opened, and considerable space in the boxes was unfilled (fig. 8).

Several shipments of beef liver were observed with evidence of considerable blood leakage, which caused blood-stained boxes. The presence of blood leakage (fig. 9) is an indication to port health authorities that the product may not be fit for human consumption. Most health officials stated that products are not rejected for human consumption based on damage or condition of packaging materials per se, but blood stains indicate that the product possibly was subjected to defrosting after initial freezing. Lots showing blood leakage are usually not cleared at customs until health authorities have defrosted and inspected a sample product from such lots. Since boxes showing blood staining were observed only on arrival in Europe, no determination could be made at what distribution stage they were actually defrosted. Many blood-stained boxes containing beef liver were opened at points of entry, and in all boxes the leakage occurred through holes or folds in the polyfilm



Figure 5.--U.S. variety meat in van container at port of Felixstowe, U.K. Note boxes do not stow properly or maintain alinement because of serious damage.

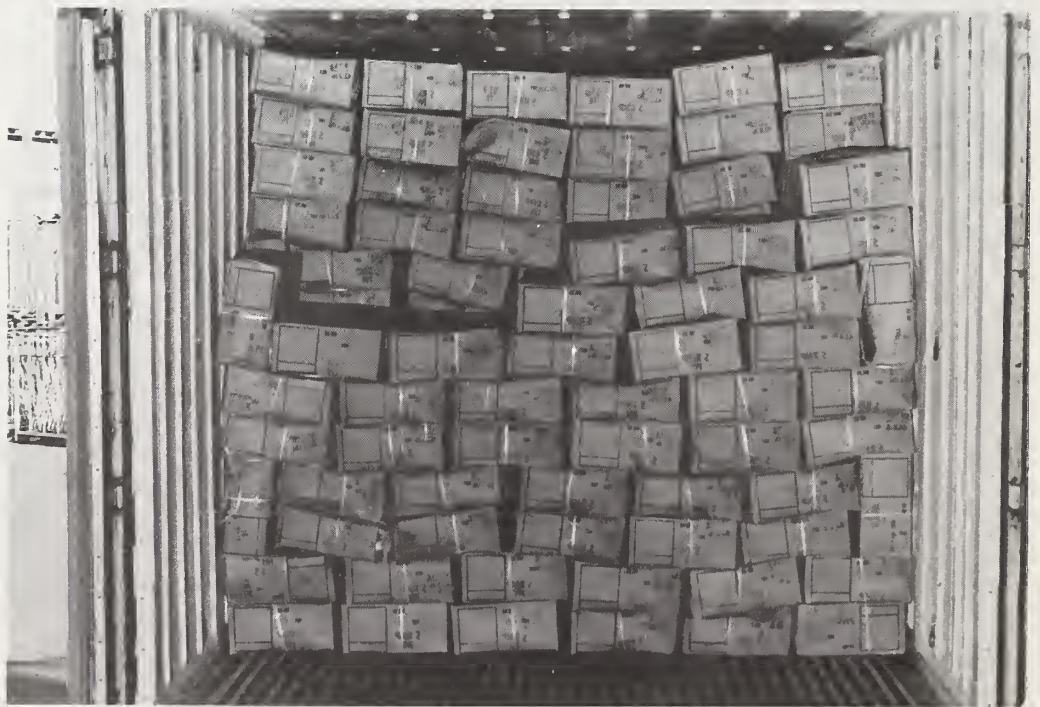


Figure 6.--U.S. variety meat in van container, London, U.K. Note some boxes are slightly deformed but maintain good alinement.



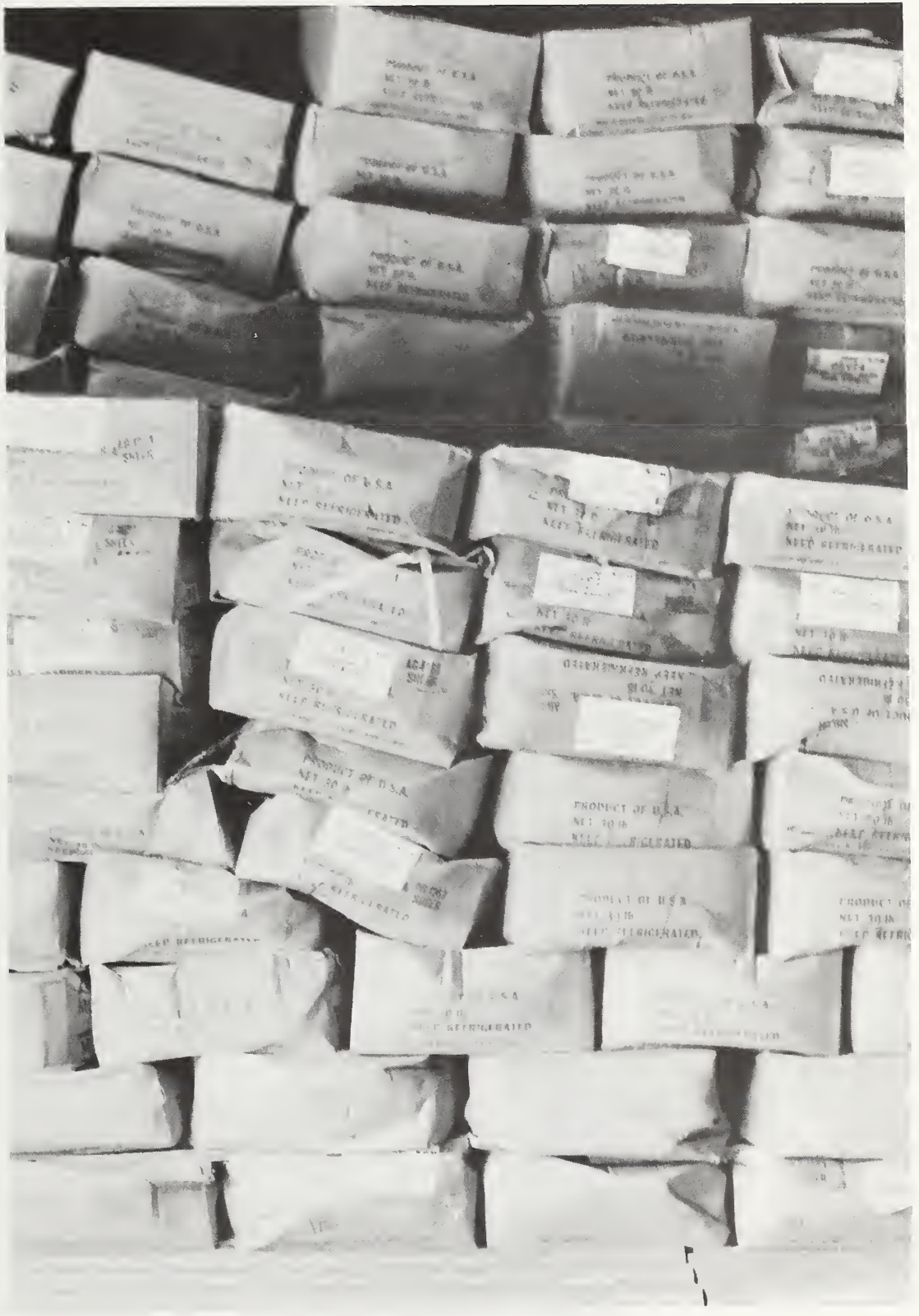


Figure 7.--Closeup of U.S. variety meat stacked in conventional ship at port of Rotterdam, Netherlands. Note most boxes are seriously crushed.



Figure 8.--Partially filled box of U.S. pork kidney.



Figure 9.--U.S. beef liver in blood-stained box.

containing the livers. Polyfilm used for beef livers should be of sufficient strength or thickness to prevent tearing during filling, freezing, and handling.

After sorting at quay side is completed, most VM discharged from conventional ships is handloaded onto lorries and delivered to public or private cold storage facilities, where it is placed either on pallet racks designed for use with removal pallet bases or on pallet bases. Pallet racks are usually stacked four to six high in storage, but when pallet bases without racks are used, they are usually stacked two to three high. Products arriving in van container shipments are handled in the same manner as products delivered to cold storage by lorries from conventional ships. When the ultimate receiver, buyer, or user takes delivery from cold storage, boxes may be loaded in the lorry by hand, on pallet racks, or on pallet bases. The handling methods depend on the receiver's requirements and the services provided by the cold storage facilities.



## CONCLUSIONS AND RECOMMENDATIONS

This study shows several major and many minor problems observed by European buyers and users of U.S. VM. Some are relatively simple to solve; others are not. The U.S. VM industry and individual U.S. packinghouses in conjunction with European buyers must decide what immediate and longer term packaging improvements should be made and which are justified based on economic cost projections. The findings of this study are presented so that individual packinghouses, meat industry trade organizations, researchers, box manufacturers, and others can make better decisions in planning future improvements in VM packaging.

Many persons interviewed during this study stated that the inherent quality of U.S. VM is excellent, but the projection of a quality product is lost through poor product presentation and packaging. Brokers and wholesalers stated that during marketing when supply is greater than demand, products not satisfactorily packaged move very slowly. The European frozen VM market is highly competitive; therefore, good product packaging compatible with handling systems will benefit exporters, importers, and users.

Most descriptions of observed packaging problems as well as reported packaging preferences for the various VM in this report are self-explanatory. There are, however, several aspects of packaging, such as box size and net weights for the various VM products, that must be discussed in relation to existing and potential handling systems. Concerning net weight per box, these findings show that most buyers and users preferred two general weight categories--11.34-15.88 and 24.95-27.22 kg. These approximate net weights are generally satisfactory for either retail or process use. Many interviewees stated that the U.S. meat industry should provide a more standardized size and net weight per box for VM. Additionally, most U.S. VM is currently arriving bulk stacked in conventional ships and van containers at European ports of entry. Most VM cargo is unitized immediately on arrival or at a transfer point during distribution to the final point of sale or use. Most receivers, handlers, and users prefer to handle this cargo when it is unitized on bases measuring 120 by 100 or 120 by 80 cm.

Given these basic parameters, the U.S. meat industry should conduct packaging research activities to develop and evaluate boxing and handling of VM that are compatible with major market demands and acceptable unitized handling systems. Developing the use of standardized box sizes that are compatible with unitized handling systems has increased for many food commodities in recent years. Other major suppliers of meat products to EC countries, such as Australia and New Zealand, have also

taken positive action toward standardizing packaging in recent years. Standardized boxes will stack more efficiently and be more stable when bulk stowage is required because of other restraints, such as costs, shape and design of ships and transport vehicles, or other physical factors limiting unitized handling.

Specifically, the U.S. meat industry should conduct a research program to improve and standardize the packaging and appearance of VM. Various VM organs should be test packaged in 60- by 40- and 40- by 30-cm boxes (length by width, outer dimensions), because these sizes fit most efficiently on the recommended size pallets. Box height may vary depending on product shape, size, and the desired product net weight per box. Boxes constructed of solid or corrugated fiberboard of various bursting strengths should be packed and tested for durability under simulated export shipping, environmental, and handling conditions. All packaging preferences discussed in this report should be considered in box development. Following the development and selection of improved standard boxes, they should be commercially packed and shipped in experimental trial shipments (both unitized and bulk stowed) to preselected cooperating export receivers. On arrival, they should be evaluated and rated for acceptability by the proposed criteria in table 9. The resulting improved boxes will reduce complaints concerning packaging by both export receivers and users of VM and thus improve the competitiveness of U.S. VM in the European market.



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# APPENDIX

Table 9.--Proposed rating criteria for future experimental packaging studies of variety meat products

Rating	Product packaging		Physical damage to box		
	Overpacking	Slack packing	Tearing	Crushing	Chafing
Excellent-----	No bulge---	None; box well filled.	None-----	None-----	None-----
Satisfactory---	Slight bulge; does not prevent proper stacking and/or stowage.	Some; does not contribute toward box damage.	Occasional slight.	Occasional slight.	Occasional slight.
Unacceptable---	Excessive bulge; impedes proper stacking and/or stowage.	Excessive; contributes toward box damage.	Consistent slight or severe.	Consistent slight or severe.	Consistent slight or severe.

Rating	Box joint(s)	Box closure(s)	Box reinforcement		Product and box labeling
			Material	Application	
Excellent-----	-----	-----	-----	-----	-----
Satisfactory---	Sufficiently glued, taped, folded, or other.	Sufficiently glued, taped, folded, strapped, or other.	Nontoxic; nonmetal.	Sufficient to reinforce box and contents.	All required information printed and legible.
Unacceptable---	Not sufficiently glued, taped, folded, stapled, stitched, or other.	Not sufficiently glued, taped, folded, strapped, stapled, stitched, or other.	Toxic; metal.	Not sufficient to reinforce box and contents.	All required information not printed or not consistently legible.



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